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Leakage of the chlorinated solvents PCE and TCE into limestone aquifers from contaminated overburden and the long-lasting back diffusion from the secondary source in the limestone matrix pose a severe risk for contamination of drinking water resources. Dechlorination of PCE and TCE in limestone often accumulates cis-DCE due to incomplete dechlorination in the limestone aquifers, as observed downgradient of a PCE and TCE DNAPL source area at Naverland in Denmark. A microcosm study with limestone core material and groundwater from the Naverland site source area spiked with PCE showed that enhanced reductive dechlorination (ERD) by the addition of donor and specific degraders (KB1® culture) can lead to complete dechlorination of PCE and TCE in the limestone aquifer, provided sufficient contact between specific degraders, donor and specific degraders, is obtained.

Advection-based delivery of donor and specific degraders is expected to result in spreading in fractures and other high permeability features only. Hence, contact between specific bacteria, donor, and contaminants in the contaminated matrix is expected to be limited by matrix diffusion and growth-based spreading of degraders causing very long remediation timeframes. Electrokinetics (EK) offers some unique transport processes, which can potentially overcome the diffusion limitations in the matrix. A novel technology combines ERD and EK for enhanced delivery. The combined technology (EK-BIO) has shown promising results in clay. Experimental work on EK-BIO in limestone was conducted in a laboratory setup with limestone cores. EK was demonstrated to be promising in establishing enhanced contact between the donor lactate, bacteria, and cis-DCE within the limestone matrix. Complete dechlorination is expected to take place in the matrix, since back diffusion limitations in the limestone matrix are overcome. This is essential for the overall time perspective of a remediation in limestone aquifers.

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